ITUEvents

ITU Regional Seminar 5G Implementation in Europe and CIS

Strategies and Policies Enabling New Growth Opportunities

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Budapest, Hungary

ITU Regional Initiatives for Europe and CIS on ICT Infrastructure Development

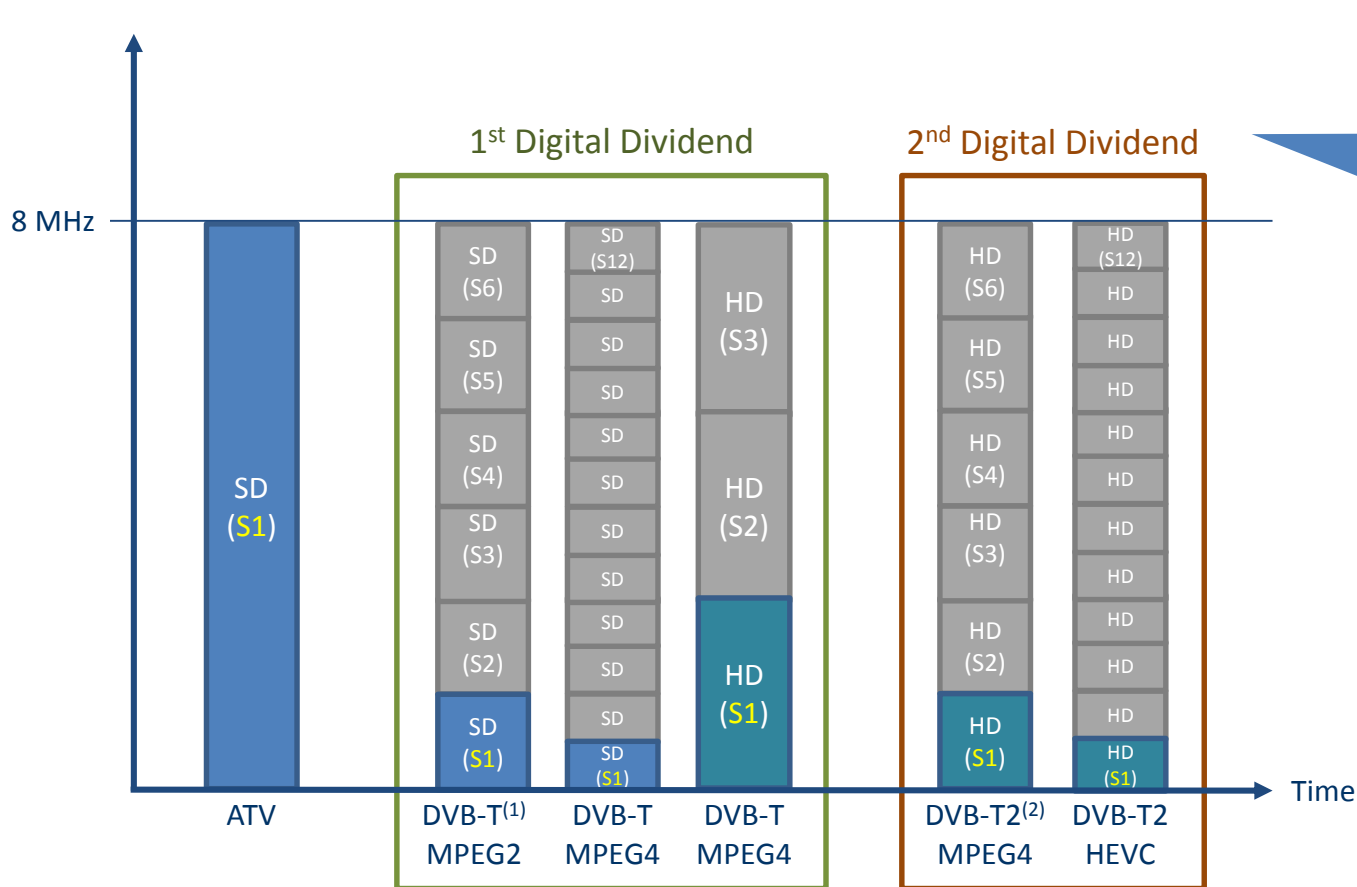# Spectrum Management decisions on the Digital Dividend

Peter Walop (ITU expert)

Agenda

Topics

1. Digital dividend allocations
2. Frequency planning

1. Digital dividend allocations

1st and 2nd dividend due to technical improvements

Size (MHz) of DD for LTE also dependent on:
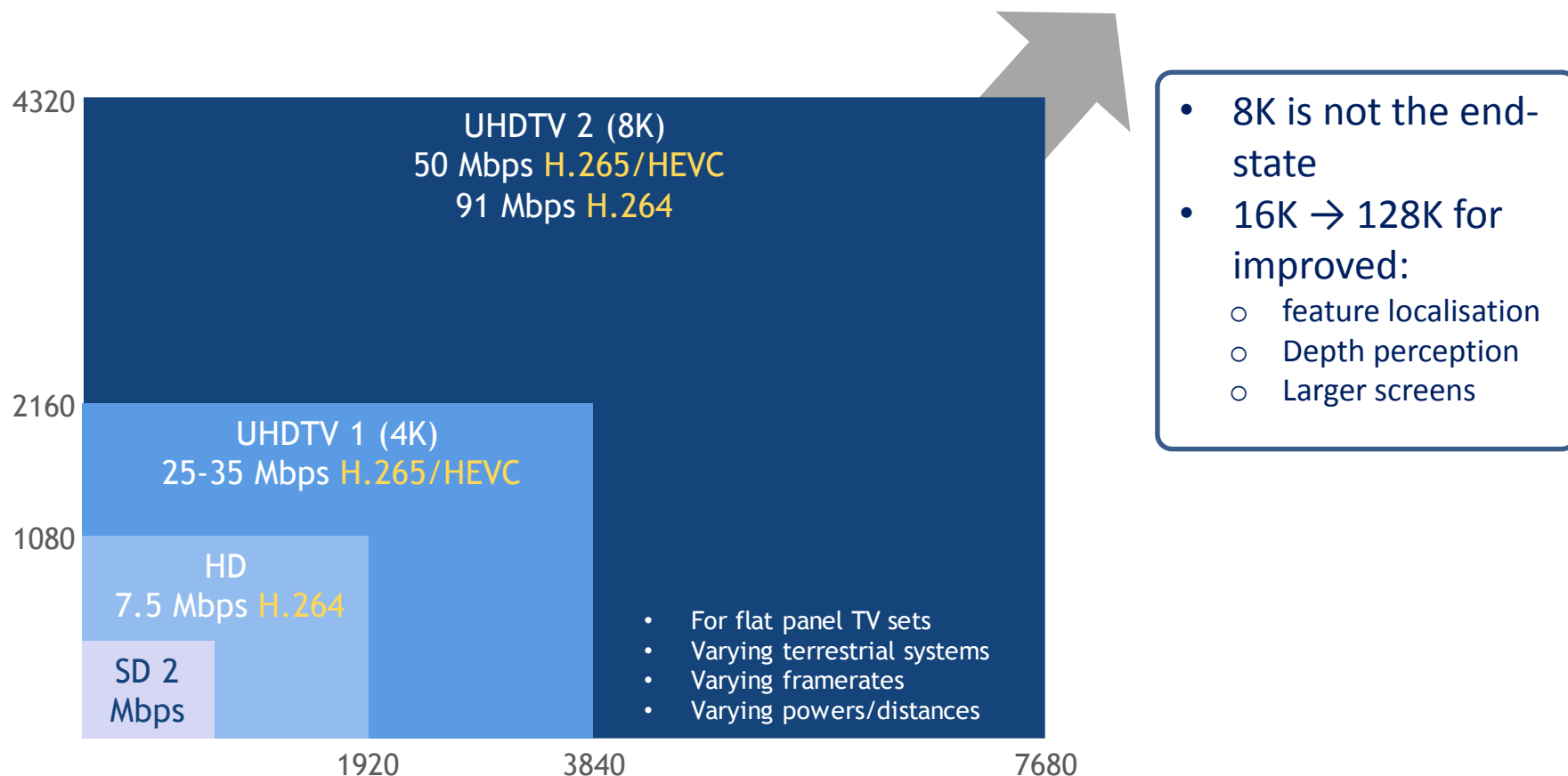# TV services, reception mode, MFN/SFN, stat mux gain, etc.

- **WRC-07:**
  o 790-862 MHz ("800 MHz") in Region 1
  o 698-790 MHz ("700 MHz") in Regions 2 and 3
- **WRC-12 & -15:**
  o 694-790 MHz ("700 MHz") in Region 1
  o 610/614-698 MHz ("600 MHz") in a few countries in Regions 2 and 3

(1)   Net bit rate: 24 Mbit/s (64QAM, CR 2/3)
(2)   Net bit rate: 40 Mbit/s (256 QAM, CR 2/3)

1.   Digital dividend allocations

More capacity needed for higher screen resolutions

4320

UHDTV 2 (8K)
50 Mbps H.265/HEVC
91 Mbps H.264

2160

UHDTV 1 (4K)
25-35 Mbps H.265/HEVC

1080

HD
7.5 Mbps H.264

SD 2
Mbps

- For flat panel TV sets
- Varying terrestrial systems
- Varying framerates
- Varying powers/distances

1920   3840   7680

Source: ITU

- 8K is not the end-state
- 16K → 128K for improved:
  - feature localisation
  - Depth perception
  - Larger screens

1. Digital dividend allocations

Lack of capacity on terrestrial platforms

Capacity gap

1st Digital Dividend

2nd Digital Dividend

8 MHz

For flat panels at home
(not for mobile)

ATV — SD (S1)

DVB-T[1] MPEG2 — SD (S6), SD (S5), SD (S4), SD (S3), SD (S2), SD (S1)

DVB-T MPEG4 — SD (S12), SD, SD, SD, SD, SD, SD, SD, SD (S1)

DVB-T MPEG4 — HD (S3), HD (S2), HD (S1)

DVB-T2[2] MPEG4 — HD (S6), HD (S5), HD (S4), HD (S3), HD (S2), HD (S1)

DVB-T2 HEVC — HD (S12), HD, HD, HD, HD, HD, HD, HD (S1)

DVB-T2 HEVC — 4K (S1)

DVB-T2 HEVC — 8K

LTE eMBMS has similar transport efficiency (Shannon limit)

(1) Net bit rate: 24 Mbit/s (64QAM, CR 2/3)
(2) Net bit rate: 40 Mbit/s (256 QAM, CR 2/3)
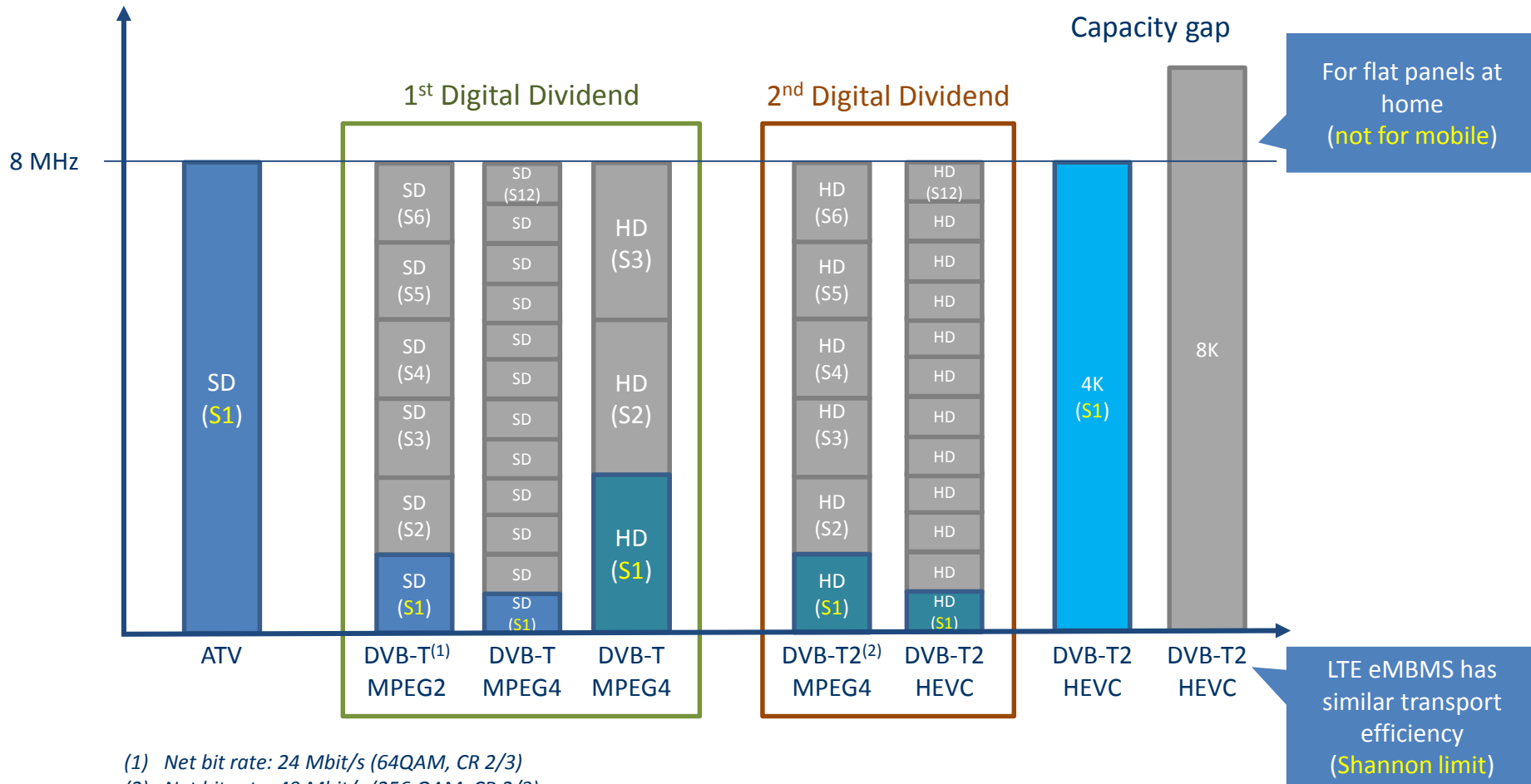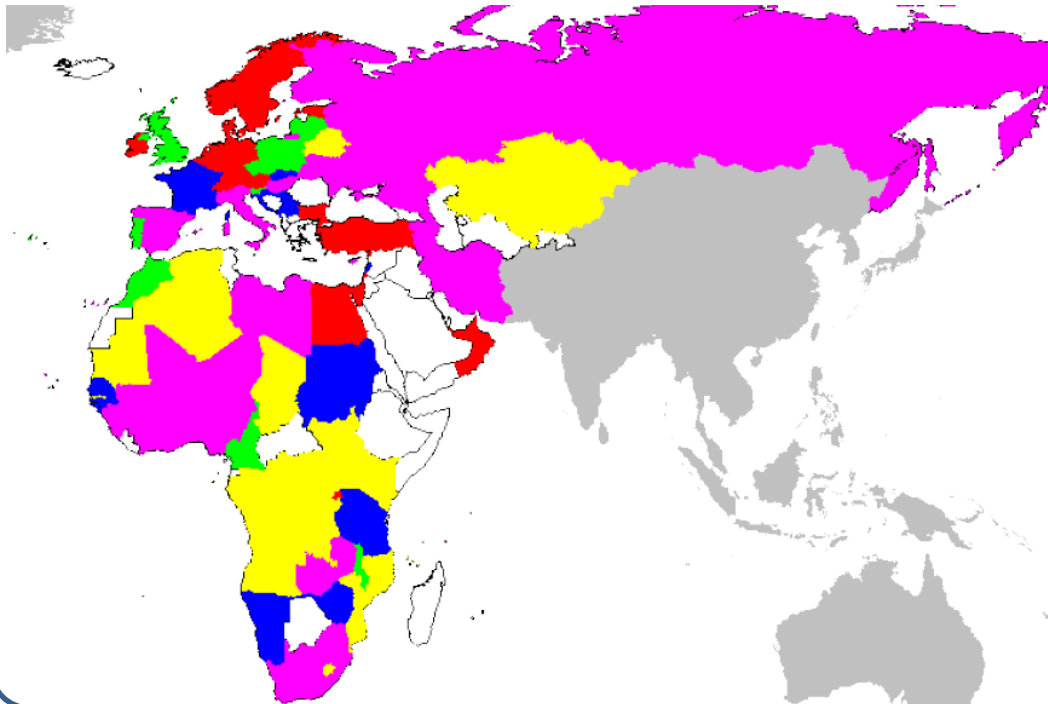
5

1.   Digital dividend allocations

Countries face different decisions for facilitating 4/8K services

Proportion of users who receive television by terrestrial broadcasting

	<25%	≥25 and <50%	≥50 and <75%	≥75%	No reply
Total administrations considered	18	11	11	28	21
Map colour					

Source: ITU-R Rep BT.2302 (2014)

1. Digital dividend allocations

LTE spectrum allocated at different speeds but trends seems clear

Allocated LTE spectrum
(1st and 2nd) Digital Dividend
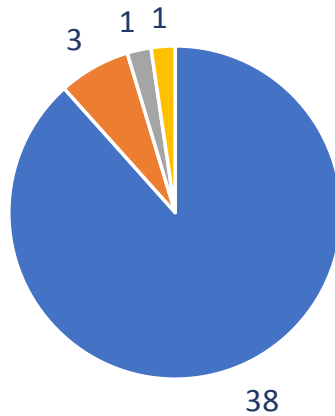

Legend: ■ 600 MHz ■ 700MHz ■ 800MHz
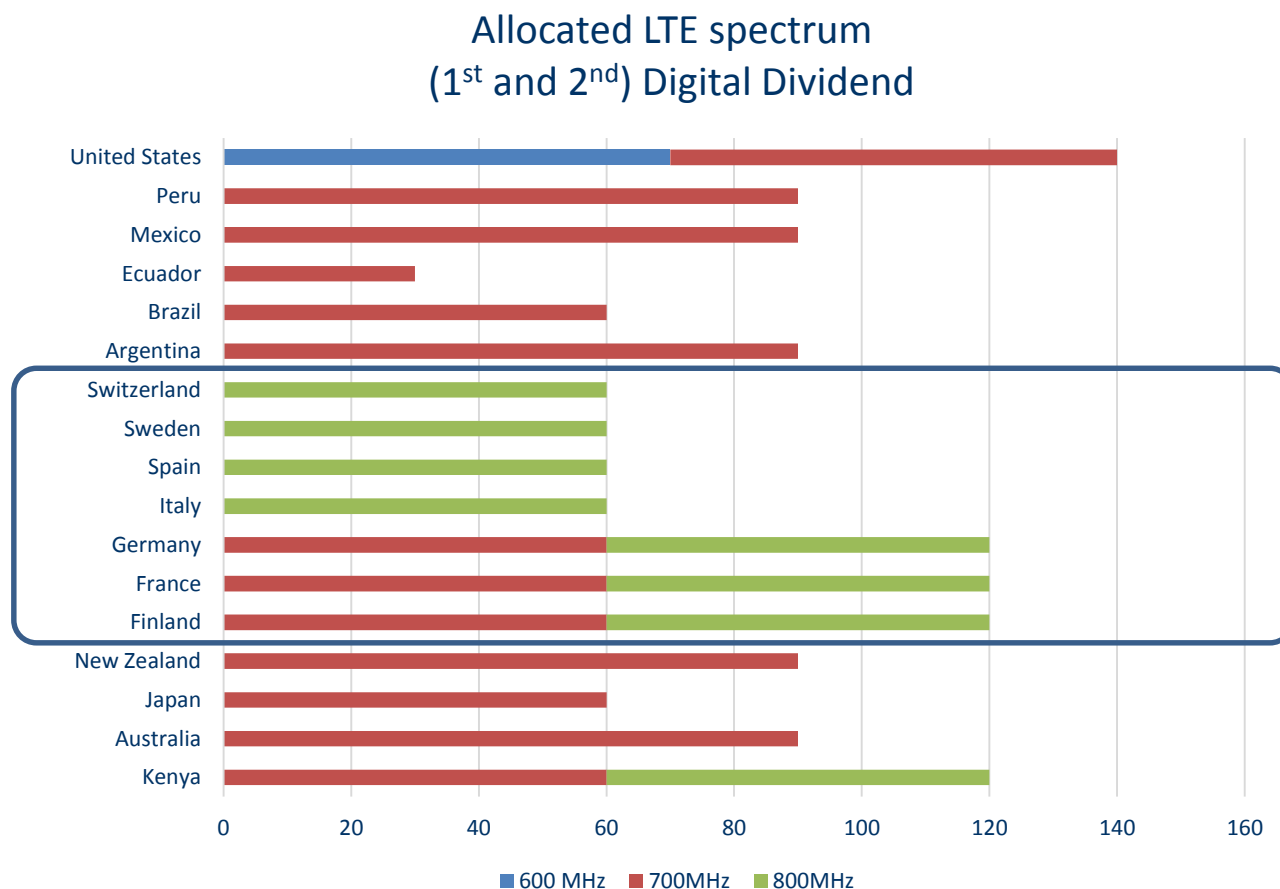
Source: ITU report " Digital Dividend: insights for spectrum decisions" (2018)

2. Frequency planning
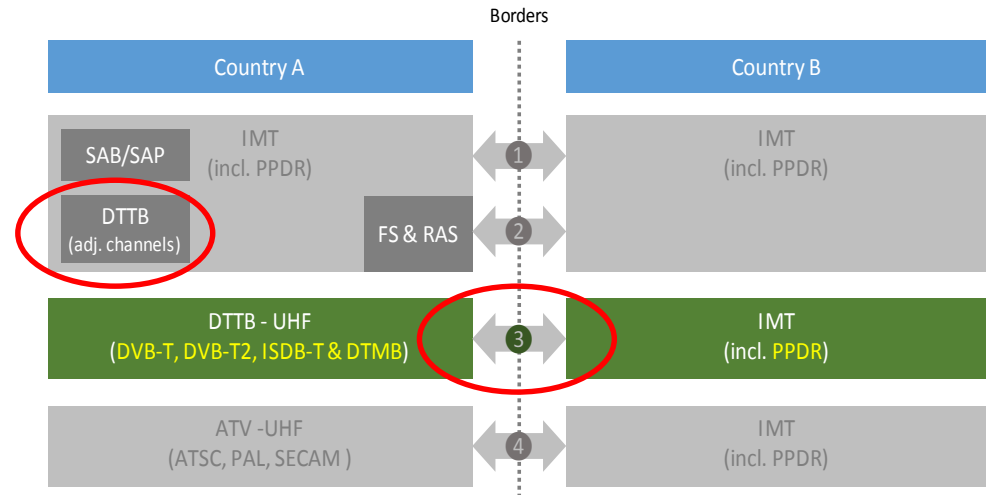## Two key frequency planning efforts needed to free-up spectrum

① DSO/ASO process (Europe)

3 1 1

38

■ Completed ■ On-going ■ not started ■ Unknown

Source: ITU-D "DSO/ASO dashboard"

② (Cross-border) frequency coordination

Borders

| Country A | | Country B |

SAB/SAP	IMT (incl. PPDR)	①	IMT (incl. PPDR)
DTTB (adj. channels)	FS & RAS	②	
DTTB - UHF (DVB-T, DVB-T2, ISDB-T & DTMB)	③	IMT (incl. PPDR)
ATV -UHF (ATSC, PAL, SECAM)	④	IMT (incl. PPDR)

2. Frequency planning
Harmful interference to be managed between services & countries

Borders

Country A	Country B
DTTB - UHF (DVB-T, DVB-T2, ISDB-T & DTMB)	IMT (incl. PPDR)

DTTB Transmitter

Mobile BS (e Node B)

❸ ❹ ❶ ❷

UE

Rooftop & Indoor DTTB Reception

Wanted signals

Unwanted signals (interference)
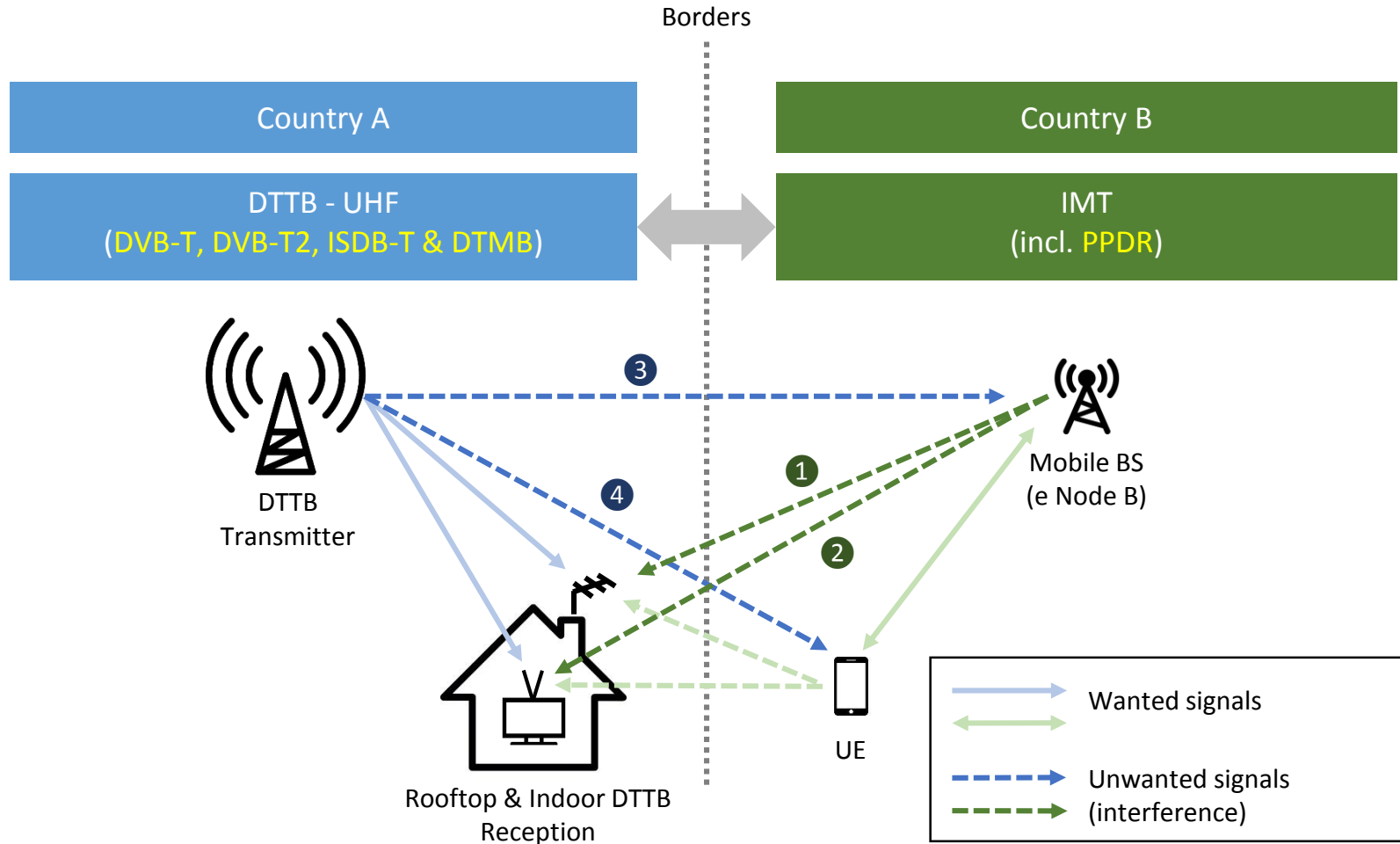
2. Frequency planning

Frequency planning and operational mitigation to be balanced

Interference type	Operational measures					
	1a. Apply filter at LTE-BS TX	2a. Apply filter at DTTB RX	3a. Reposition or change of DTTB rooftop antenna	4a. Reposition or change LTE BS antenna	5a. Reduce ERP of LTE BS TX	6a. Increase distance between UE and DTTB RX
LTE BS TX > DTTB RX (overloading)		√	√	√	√	
LTE BS TX > DTTB RX (unwanted emissions)	√		√	√		
LTE BS TX > DTTB RX (auto gain controller)		√	√	√	√	
LTE BS TX > DTTB RX, (image channel)		√	√	√	√	

Interference type						
DTTB signal > LTE BS (overloading)						
DTTB signal > LTE BS (unwanted emissions)						
DTTB signal > LTE UE RX (overloading)						√	
DTTB signal > LTE UE RX (unwanted emissions)	√					√	

Source: Anatel

NRAs make trade-offs between:

1. Imposing technical requirements (e.g. BS filtering) and re-planning stations during deployment
2. Applying operational measures (e.g. distributing consumer filters)